

FAME Spacecraft Science Data Time Tagging an

Requirement:

- Onboard universal time knowledge of 1 msec

Approach with Instrument Active:

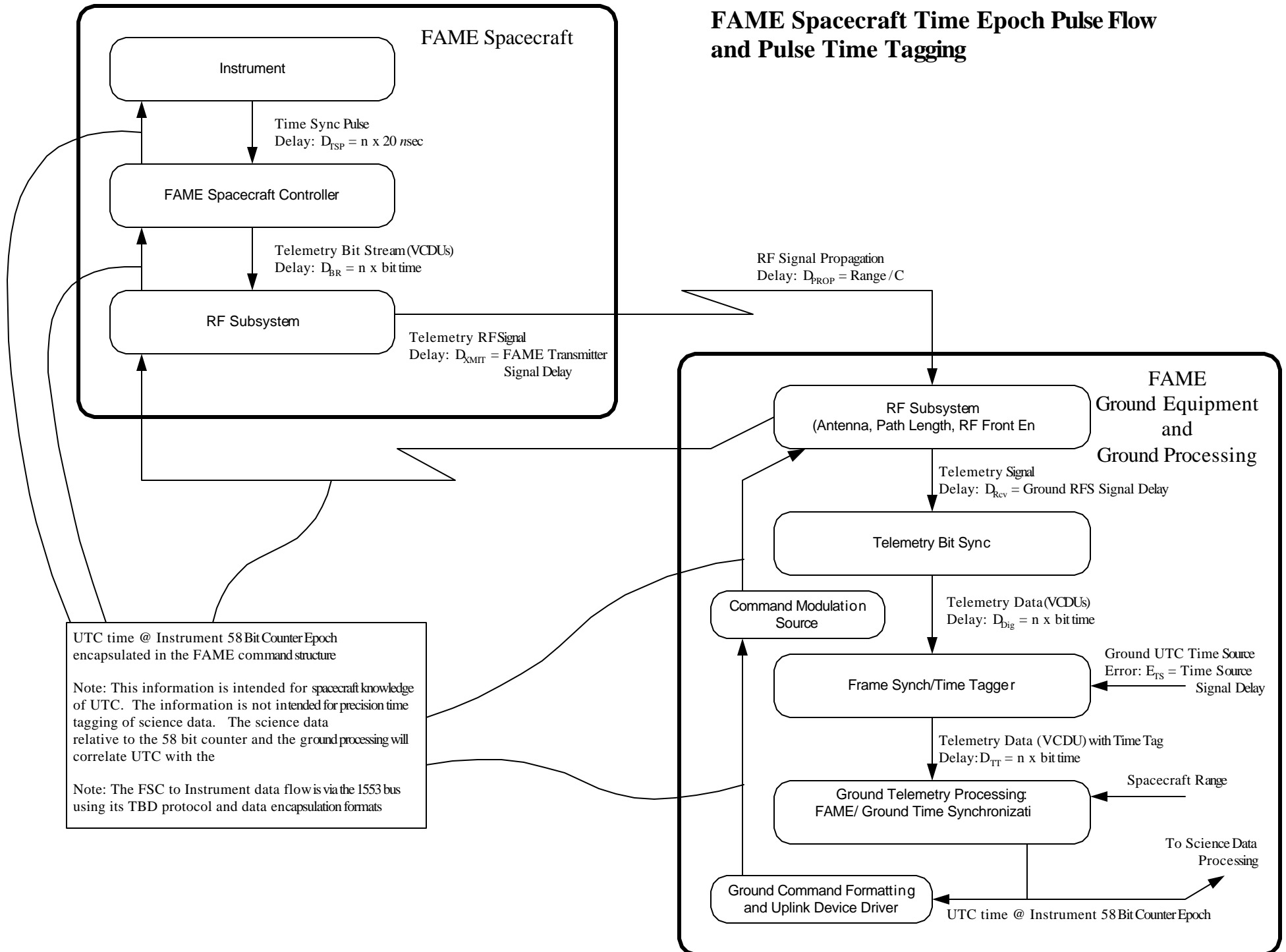
- Associate Instrument generated time epoch pulse with a bit in the telemetry data stream
- Generate the Instrument time epoch pulse from a transition in a selected bit (i.e. 18th) of the 58 bit Instrument time counter
- The 58 bit Instrument time counter is incremented using the 50 Mhz Instrument Oscillator
- The 58 bit Instrument time counter is used
- The Blossom Point ground hardware will associate ground station time with the first bit of each VCDU
- The Blossom Point ground processing will associate absolute UTC time with the value of the 58 bit counter
- The Blossom Point ground processing will distribute the UTC/58 Bit count values for mission data processing and spacecraft use

Approach with Instrument Inactive:

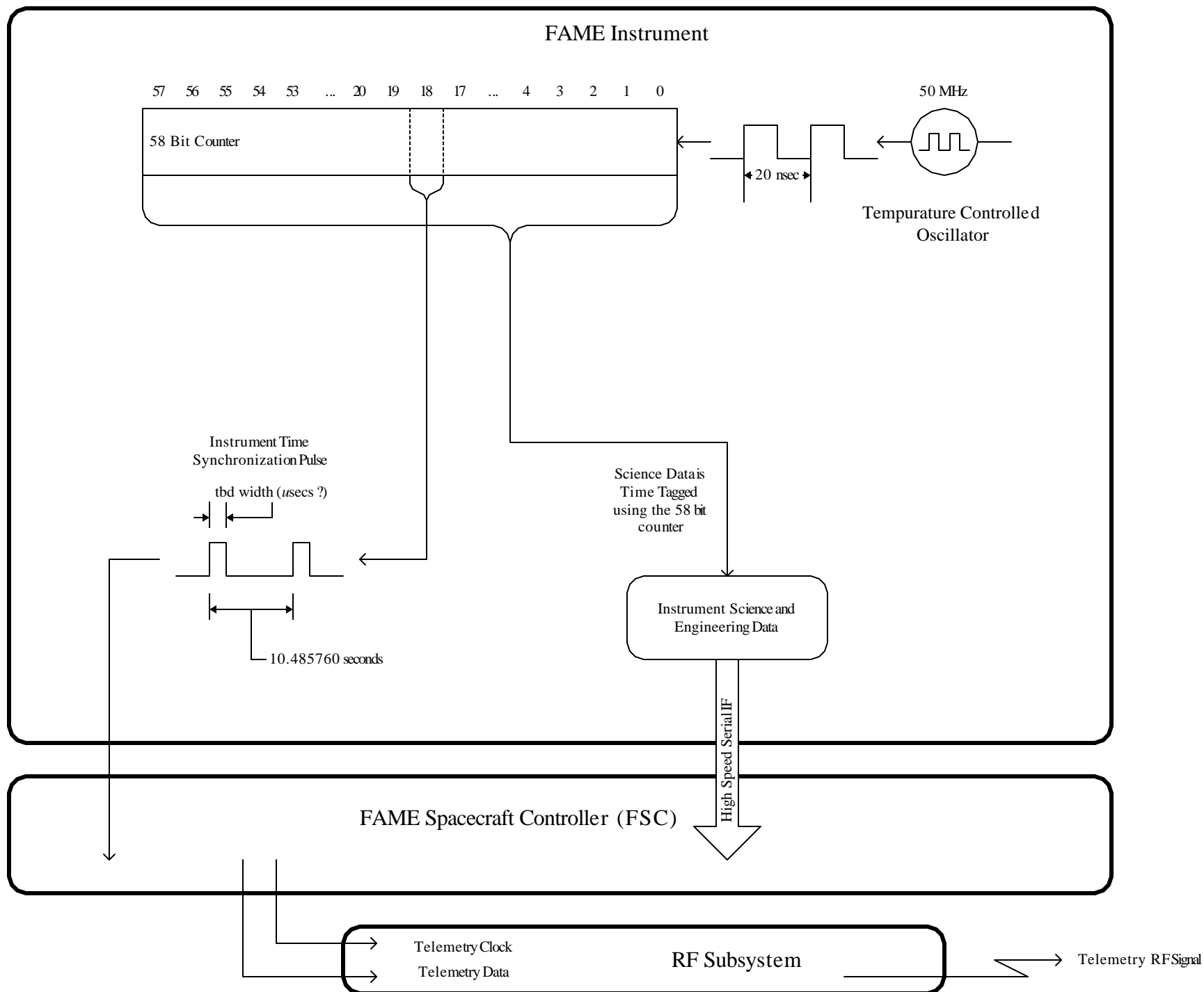
- Associate FSC time with a bit in the
- The FSW Telemetry FIFO logic in the Uplink Downlink Interface Module will generate half empty interrupts
- The FSW Telemetry FIFO will be sized for 2 VCDUs minus 1
- The FSC software (ISR) will latch FSC time and the VCDU counter value (n) when the half-empty FIFO is generated
- The half-empty FIFO interrupt will correspond to the time when the VCDU counter value $n-1$ is clocked to the FAME RF subsystem
- The FSC time and associated count (VCDU counter value - 1) will be formulated into an application packet and downlinked periodically
- The Blossom Point ground hardware will associate ground station time with the first bit of each VCDU
- The Blossom Point ground processing will determine the delta between FSC time and UTC using the VCDU time and downlinked time packet
- The Blossom Point ground processing will uplink the time delta to correct the onboard time

- Science data time tagging requirement (1 msec ?)
- Instrument UTC time knowledge requirement
- FSC UTC time knowledge requirement (accuracy ?)

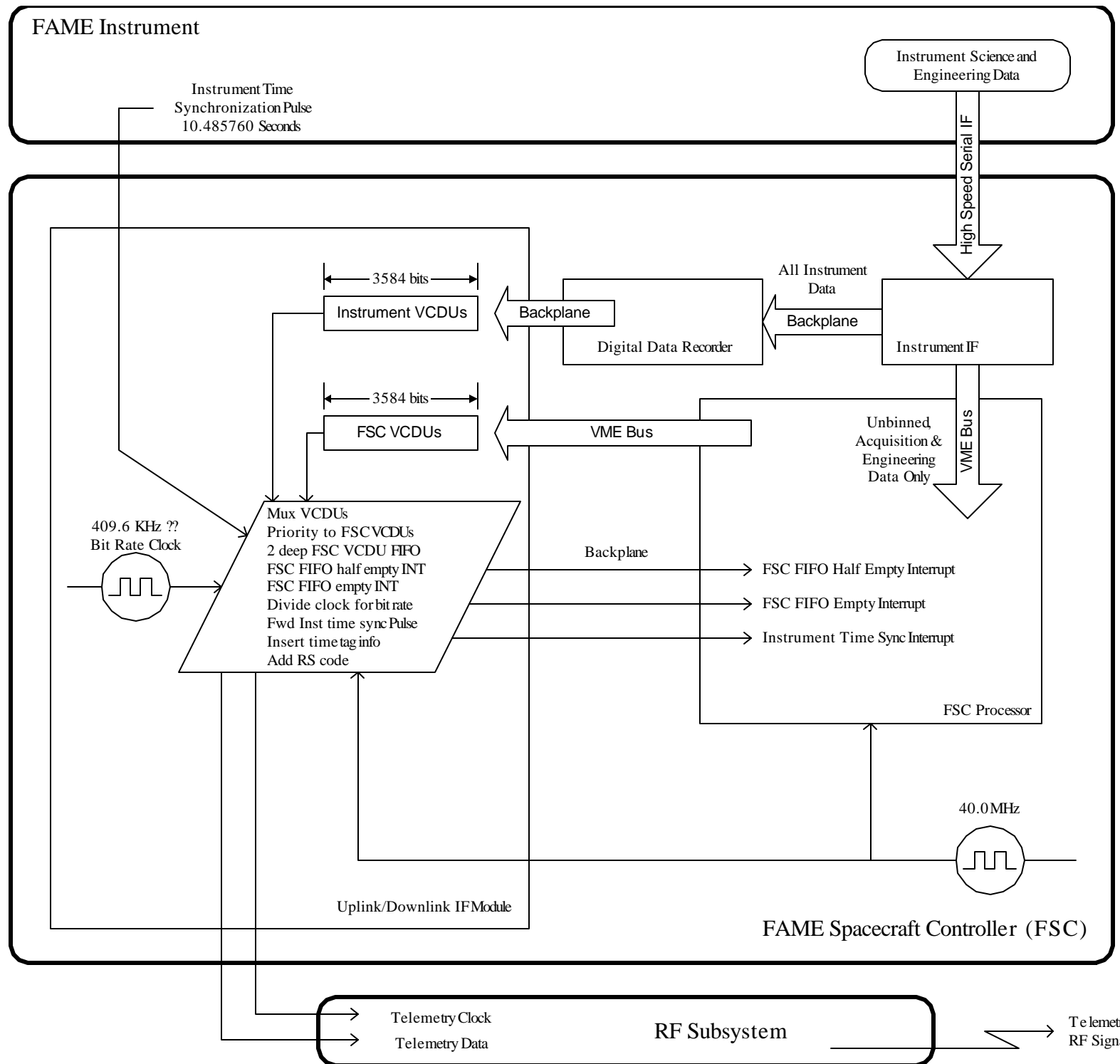
FAME Spacecraft Time Epoch Pulse Flow and Pulse Time Tagging



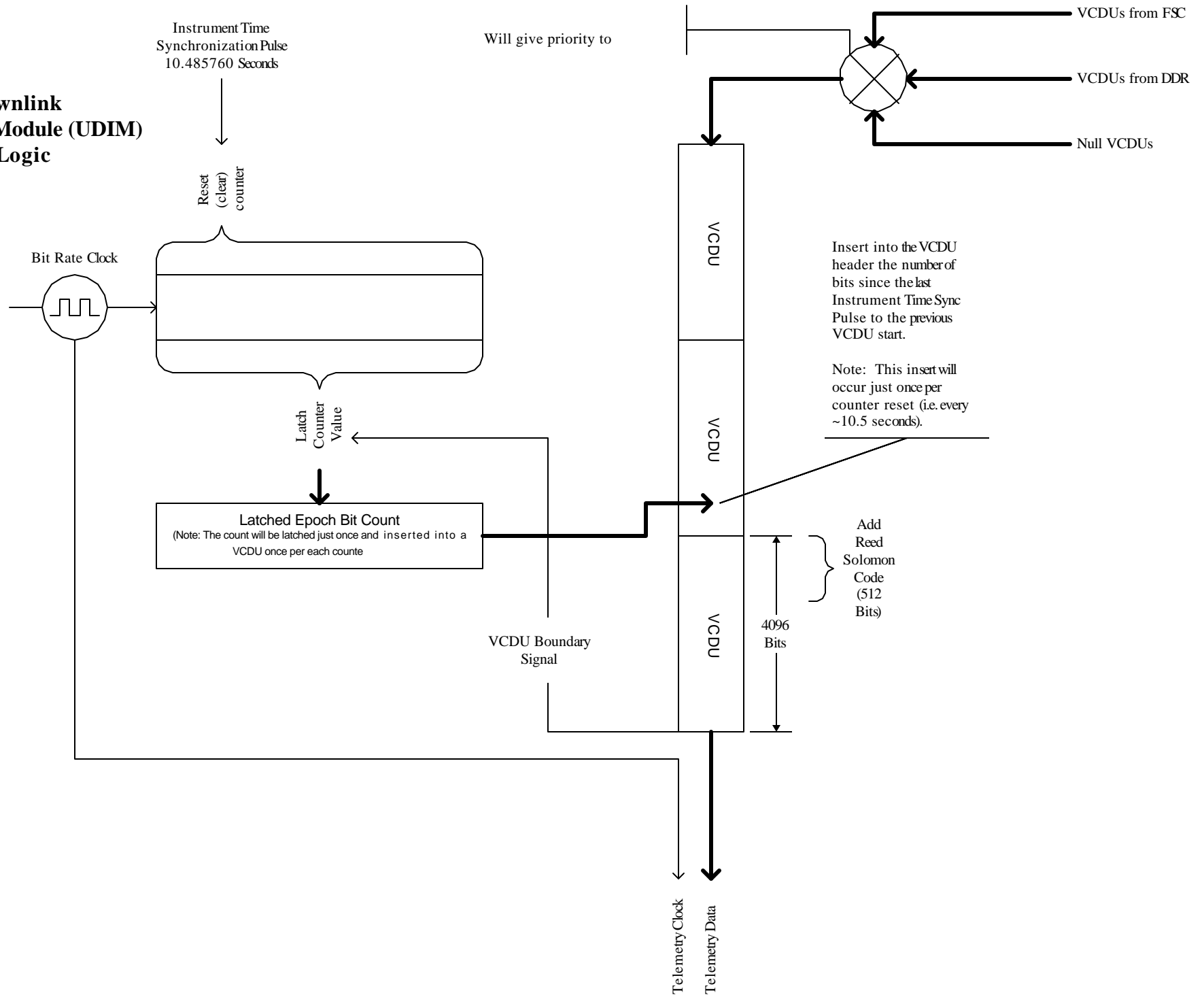
FAME Spacecraft Time Epoch Pulse Flow: I



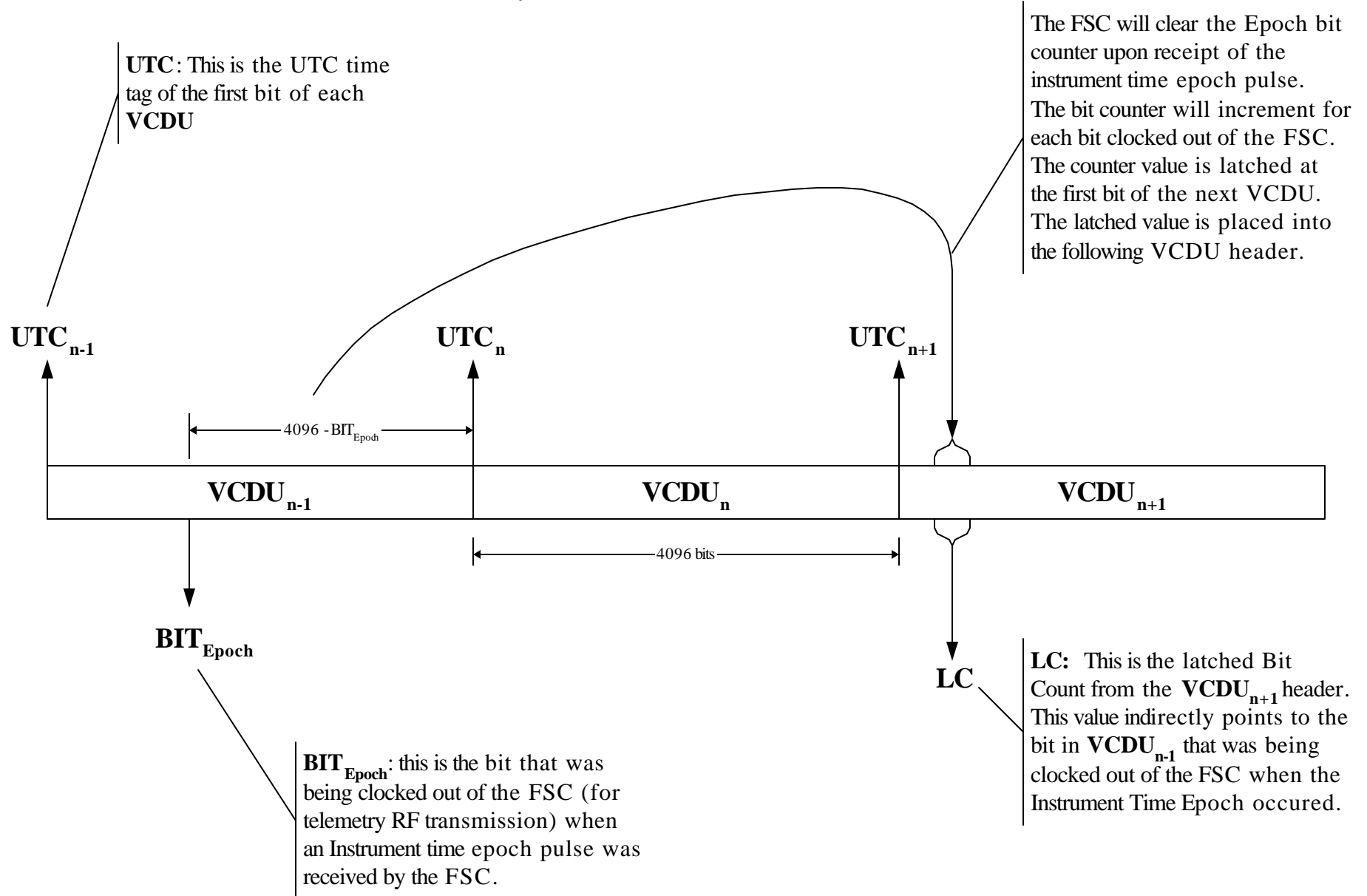
FAME Spacecraft Time Epoch Pulse Flow: FSC



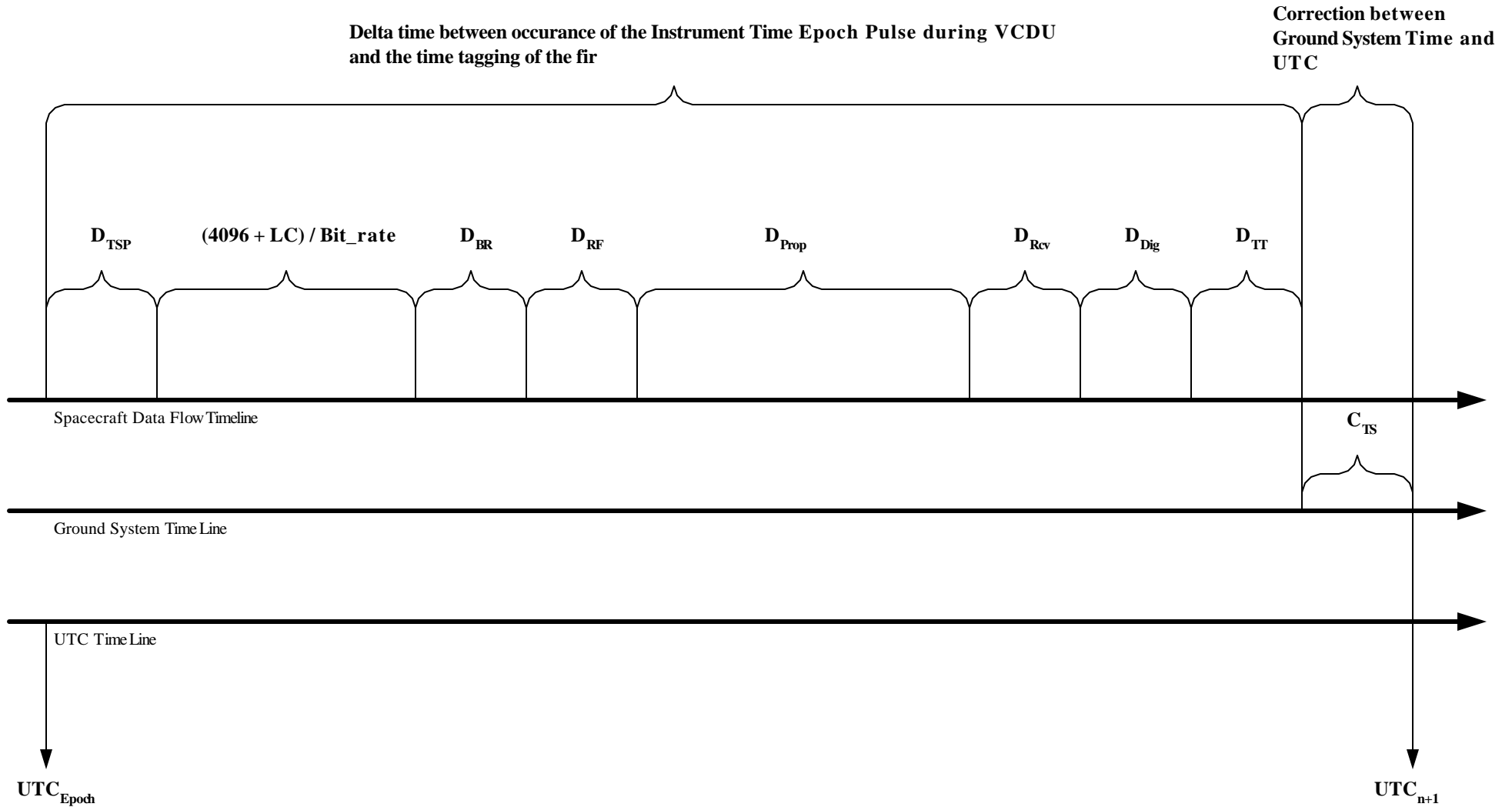
Uplink/Downlink Interface Module (UDIM) Time Tag Logic



Relationship Between Instrument T Telemetry Data Stream C



Relationship Between Instrument T Ground Time Tag of



$$UTC_{Epoch} = UTC_{n+1} - (D_{TSP} + ((4096 + LC)/\text{Bit_rate}) + D_{BR} + D_{RF} + D_{Prop} + D_{rcv} + D_{Dig} + D_{TT} + C_{TS})$$

Error will be calculated by the uncertainty in each of the delays and correction

UTC / FAME Time Synchronization when the Instrument is powered off

